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# Fasteners and Metals

David F. Alderman

NIST HANDBOOK 150-18

U.S. Department of Commerce
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NIST HANDBOOK 150-18

# National Voluntary Laboratory Accreditation Program

# Fasteners and Metals

David F. Alderman

August 1996

**U.S. Department of Commerce**
Michael Kantor, Secretary

Technology Administration
Mary L. Good, Under Secretary for Technology

National Institute of Standards and Technology
Arati Prabhakar, Director

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# PREFACE

NIST Handbook 150-18 presents the technical requirements of the National Voluntary Laboratory Accreditation Program (NVLAP) for accreditation of laboratories under the Fasteners and Metals program. It is intended for information and use by staff of accredited laboratories, those laboratories seeking accreditation, other laboratory accreditation systems, users of laboratory services, and others needing information on the accreditation requirements.

This publication supplements the Fastener Quality Act (PL 101-592) as amended by the National Technology Transfer and Advancement Act (PL 104-113) and its implementing regulations as described in Title 15, Part 280 of the U.S. Code of Federal Regulations, and NIST Handbook 150, *NVLAP Procedures and General Requirements* (which contains all general NVLAP procedures, criteria, and policies).

The criteria in NIST Handbook 150 encompass the requirements of ISO/IEC Guide 25:1990 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987). The provisions of NIST Handbook 150 shall remain in effect for this accreditation program except as superseded by PL 101-592 and its implementing regulations and documented in this handbook.

The numbering of the sections of NIST Handbook 150-18 is patterned after NIST Handbook 150; for example, Section 285.3 of Handbook 150 presents the description and goal of NVLAP, whereas Section 285.3 of Handbook 150-18 presents the description of the Fasteners and Metals accreditation program. Where the material in Handbook 150 is not specific to the Fasteners and Metals program, the section number is omitted.

Any questions or comments on this handbook should be submitted to the National Institute of Standards and Technology/NVLAP, Building 820, Room 282, Gaithersburg, MD 20899; phone (301) 975-4016; fax (301) 926-2884; e-mail NVLAP@nist.gov.

# ACKNOWLEDGMENTS

Thanks are due to all those who contributed to the contents of this handbook. The experience and knowledge gained since the inception of the Fastener Quality Act dictated that we completely revise the draft handbook to reflect new requirements and information.

Special recognition is due Wayne Stiefel, who compiled and edited the initial draft of this handbook. Additional acknowledgment is due to the many people and NVLAP technical experts who provided helpful comments and suggestions to develop the program. Also, thanks are extended to Vanda R. White, whose efforts brought this handbook to fruition.

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# SUMMARY

Any laboratory (including commercial, manufacturer, university, or federal, state, or local government laboratory) that performs consensus test methods on fasteners and metals may apply for NVLAP accreditation. Accreditation will be granted to a laboratory that satisfactorily fulfills the conditions for accreditation defined in NIST Handbook 150, *NVLAP Procedures and General Requirements*, the superseding requirements defined in PL 101-592, the Fastener Quality Act, as amended by the National Technology Transfer and Advancement Act, PL 104-113, and the implementing regulations described in Title 15, Part 280 of the U.S. Code of Federal Regulations. These conditions include satisfactory performance in selected proficiency testing as required, and fulfilling the on-site assessment requirements, including resolution of any identified deficiencies. The names of NVLAP-accredited laboratories are published in the NVLAP annual directory and other media to which information is regularly provided. The names of NVLAP-accredited fastener testing laboratories will also be published in the NIST list of all testing laboratories accredited under the requirements of the Fastener Quality Act.

*Test methods covered:* Standards and specifications which are published by a consensus standards organization or by a government agency in the areas of chemical analysis, dimensional inspection, mechanical and physical testing and inspection, metallography, and nondestructive inspection.

*Period of accreditation:* One year, renewable annually.

*On-site assessment:* Visit by a technical expert to determine compliance with the NVLAP criteria before initial accreditation and every two years thereafter. Additional monitoring visits as required.

*Assessors:* Technical experts with experience in the appropriate field of testing.

*Proficiency testing:* Each laboratory is required to test and analyze proficiency testing sample material(s). The completed test data report is sent to NVLAP, or as directed to the proficiency testing contractor. A summary of results is sent to the participants.

*Granting accreditation:* Based upon satisfactory on-site assessment and resolution of deficiencies, proficiency testing, and technical evaluation of applicable laboratory information. A Certificate and Scope of Accreditation are issued to the laboratory.

*Fees:* Payments are required as listed on the NVLAP fee schedule.

## Sec. 285.1 Purpose

The purpose of this handbook is to set out procedures and technical requirements for accreditation by NVLAP of laboratories which perform testing on fasteners and metals using standards and specifications which are published by a consensus standards organization or by a government agency in the areas of chemical analysis, dimensional inspection, mechanical and physical testing and inspection, metallography, and nondestructive inspection.

This handbook complements and supplements the NVLAP programmatic procedures and general requirements found in NIST Handbook 150 and the superseding requirements found in the Fastener Quality Act, PL 101-592, as amended by the National Technology Transfer and Advancement Act, PL 104-113, and its implementing regulations as described in Title 15, Part 280 of the U.S. Code of Federal Regulations. The interpretive comments and additional requirements contained in this handbook make the general NVLAP criteria specifically applicable to the Fasteners and Metals program. Specific circumstances under which departures from the NVLAP general procedures are allowable within the scope of the Fasteners and Metals program are also addressed in this handbook.

## Sec. 285.2 Organization of procedures

(a) The handbook is organized to cross-reference with NIST Handbook 150, *NVLAP Procedures and General Requirements*. The format and subject headings used in this handbook, including the checklist found in Appendix B, are consistent with Handbook 150.

(b) The handbook contains five appendices:

(1) Appendix A provides examples of a Certificate of Accreditation and a Scope of Accreditation for the Fasteners and Metals program;

(2) Appendix B provides the General Operations Checklist which NVLAP assessors use during an on-site assessment to evaluate a laboratory's ability to conduct testing in general;

(3) Appendix C provides the Specific Operations Checklist which NVLAP assessors use during an on-site assessment of a laboratory that performs testing on fasteners and metals;

(4) Appendix D provides the sheets that the assessor completes in conducting a review of the test methods; and

(5) Appendix E lists the testing areas, groups and subgroups for the Fasteners and Metals accreditation program.

## Sec. 285.3 Description of Fasteners and Metals program

The Fastener Quality Act (FQA), Public Law 101-592, was signed by President Bush on November 16, 1990. The Act protects the public safety by: (1) requiring that certain fasteners sold in commerce conform to the specifications to which they are represented to be manufactured, (2) providing for accreditation of laboratories engaged in fastener testing, and (3) requiring inspection, testing and certification in accordance with standardized methods.

The Act requires the Secretary of Commerce, acting through the Director of NIST, to establish a laboratory accreditation program for fastener testing laboratories under the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP). The accreditation program includes test methods which are required by fastener specifications or standards covered by the Act. Since fastener testing involves a wide range of expertise, accreditation will be offered in the areas of mechanical and physical testing and inspection, metallography, nondestructive inspection, dimensional inspection, and chemical analysis.

On March 7, 1996, President Clinton signed the National Technology Transfer and Advancement Act of 1995, Public Law 104-113, which amended the Fastener Quality Act to further clarify and define the requirements of the original Act.

## Sec. 285.4 References

References and sources for the Fasteners and Metals program follow:

(a) NIST Handbook 150, *NVLAP Procedures and General Requirements* (March 1994); available from:

NIST/NVLAP
Building 820, Room 282
Gaithersburg, MD 20899

Phone: (301) 975-4016
Fax: (301) 926-2884
E-mail: nvlap@nist.gov;

**(b)** Fastener Quality Act, Public Law 101-592, 1990; available from depository libraries of the United States or a local public library;

**(c)** Procedures for Implementation of the Fastener Quality Act, Title 15, Part 280 of the U.S. Code of Federal Regulations (CFR); available from:

Superintendent of Documents
U.S. Government Printing Office (GPO)
Washington, DC 20402

Phone: (202) 512-1800
Fax: (202) 512-2250;

**(d)** National Technology Transfer and Advancement Act of 1995, Public Law 104-113; available from U.S. Government Printing Office (GPO)—see address above.

**Sec. 285.5 Definitions**

**Accuracy of measurement:** Closeness of the agreement between the result of a measurement and a true value of the measureand. [*International Vocabulary of Basic and General Terms in Metrology* (VIM), 3.5]

**Consensus standards organization:** The American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), American Society of Mechanical Engineers (ASME), Society of Automotive Engineers (ASE), or any other consensus standards setting organization (domestic or foreign) determined by the Secretary of Commerce to have comparable knowledge, expertise, and concern for the health and safety in the field for which such organization purports to set standards. [15 CFR Part 280, Sec. 280.2]

**Date of manufacture:** The date upon which the initial conversion of material into a fastener takes place. [15 CFR Part 280, Sec. 280.2]

**Fastener:** Any screw, nut, bolt or stud, washer or other item included within the definition for *fastener* contained in section 3(5) of the Fastener Quality Act. The term *fastener* does not include a screw, nut, bolt, or stud:

(1) that is produced and marked as ASTM A307 Grade A;

(2) that is produced in accordance with ASTM F432; or

(3) that is held out as being produced to other than the provisions of a document published by a consensus standards organization, or a government agency.

A screw, nut, bolt, stud or washer held out as being produced according to requirements of a document other than a document published by a consensus standards organization is a fastener within the meaning of the Act and this part if that document incorporates or references (directly or indirectly) standards and specifications published by a consensus standards organization or government agency for purposes of delineating performance or materials characteristics of the fastener. [15 CFR Part 280, Sec. 280.2]

**Original Laboratory Testing Report:** A laboratory testing report which is originally signed by an Approved Signatory or is a copy thereof, certified by the laboratory that conducted the test. [15 CFR Part 280, Sec. 280.2]

**Standard Reference Material (SRM):** A reference material certified and distributed by the National Institute of Standards and Technology (NIST).

**Standards and specifications:** The provisions of a document published by a consensus standards organization, or a government agency. [15 CFR Part 280, Sec. 280.2]

**Tamper-resistant system:** The use of special paper or embossing stamps or other controls which discourage, prevent or minimize alteration of test reports subsequent to manufacturing, inspection and testing. [15 CFR Part 280, Sec. 280.2]

**Sec. 285.6 NVLAP documentation**

Checklists contain definitive statements or questions about all aspects of the NVLAP criteria for accreditation. NVLAP programs incorporate two types of checklists:

**(a)** The NVLAP General Operations Checklist addresses factors applicable to evaluating a laboratory's ability to conduct testing in accordance with the procedures and general requirements for accreditation. The factors include, but are not limited to, the laboratory's organization,

management, and quality system in addition to its testing competency.

The General Operations Checklist, presented in Appendix B, is numbered to correspond to the requirements in NIST Handbook 150. The comment sheets are used by the assessor to explain findings and deficiencies noted on the checklist, as well as to make comments on aspects of the laboratory's performance other than deficiencies.

(b) The Specific Operations Checklist contains statements or questions that are specific to the Fasteners and Metals program. This checklist is contained in Appendix C, along with a comment sheet(s) similar to that used with the General Operations Checklist.

**Sec. 285.22 Assessing and evaluating a laboratory**

**(a) On-Site Assessment**

**(1)** The NVLAP assessor may request manuals and/or documented procedures in advance of the on-site assessment to reduce time at the laboratory. Documents supplied in advance will be returned. The laboratory should be prepared for conducting test demonstrations, have equipment in good working order, and be ready for examination according to the requirements identified in this handbook, NIST Handbook 150, and the laboratory's quality manual. The assessor will need time and work space to complete assessment documentation during the visit.

**(2)** In addition to the checklists, to help assure the completeness, objectivity, and uniformity of the on-site assessment, the assessor uses the On-Site Assessment—Test Method Review sheets (Appendix D) in reviewing the laboratory's ability to perform the test methods. The test method review ranges from observing tests to having laboratory staff describe the test procedures. The assessor notes the depth into which each part of the test method was reviewed and records the results of the review on the On-Site Assessment—Test Method Review Summary (p. D-4).

**(3)** An assessor performs the following activities during a typical on-site assessment:

**(i)** Conducts an entry briefing with the laboratory manager to explain the purpose of the on-site visit and to discuss the schedule for the day(s). At the discretion of the laboratory manager, other staff may attend the briefing.

**(ii)** Reviews laboratory quality manual (if not previously requested and supplied) and records. At least one laboratory staff member must be available to answer questions; however, the assessor may wish to review the documents alone. The assessor does not usually ask to take any laboratory documents with him/her and documents previously supplied will be returned.

**(iii)** Physically examines equipment and facilities and observes the demonstration of selected procedures by appropriate personnel assigned to conduct the tests, and interviews those personnel. The demonstrations requested may be selective or all-inclusive, and must include sample test material(s), preparation of devices, establishment of test conditions and the setup/use of major equipment. The assessor may provide proficiency test samples and request a specific demonstration.

**(iv)** Completes an On-Site Assessment Report, which contains the minimum requirements prescribed in NIST Handbook 150, as well as copies of the completed checklists. At the exit briefing, the report is signed by the assessor and the laboratory's Authorized Representative to acknowledge the discussion, but does not necessarily indicate agreement; challenge(s) may be made through NVLAP. All observations made by the NVLAP assessor are held in the strictest confidence.

**(b) Proficiency Testing**

**(1)** The proficiency testing program may be conducted by NVLAP or by a NVLAP-approved contractor. Proficiency testing materials are chosen to test the laboratory's ability to follow a method and to achieve the proper accuracy and precision.

**(2)** Laboratories will be sent test materials, data sheets, and instructions for performing the

test and reporting the results. The test shall be conducted in accordance with a specific test method using the laboratory's normal operating procedures. Proficiency testing shall not be contracted out to another laboratory. Any special NVLAP instructions shall also be followed. The special instructions are designed to ensure uniformity in procedures among participants. Completed data sheets shall be returned to NVLAP or its designated contractor for analysis by a specified date. Failure to return the proficiency testing data sheets by the deadline date will result in penalties which may include failing that round.

**(3)** Proficiency testing may involve materials or artifacts that must be returned to NVLAP for use by other participants. These materials shall be protected from damage both in the laboratory and during shipment back to NVLAP, or its designated contractor. Examples of such materials and artifacts are: filters, grids, photographs and data sheets. These materials may be used to determine testing performance for specific subparts of the test method. Unless otherwise noted, laboratories should keep proficiency testing materials for use as in-house instructional material.

**(4)** On occasion, the on-site assessor hand carries proficiency test samples to the laboratory. These proficiency test samples, like all others received by the laboratory, are to be listed or entered into the normal sample tracking and identification system for control and data recording. In these cases, the samples may be returned to the on-site assessor rather than stored at the laboratory. Additionally, in some cases, the laboratory may be instructed to send the samples back to the proficiency testing contractor, or to a destination specified by NVLAP or the proficiency testing contractor.

**(5)** The results of the proficiency testing program will be reported to the participants and in appropriate documents and reports. The identity and performance of individual laboratories will remain confidential. The results of proficiency testing will be made available to on-site assessors for use during laboratory visits. Any problems indicated by proficiency testing will be discussed with appropriate laboratory personnel, who will then be responsible for developing and implementing plans for resolving the problems. Accreditation decisions will be based on satisfactory resolution of proficiency testing deficiencies.

**(6)** Participation in proficiency testing is required for laboratories applying for accreditation for test methods under Rockwell hardness of fasteners (externally threaded), axial tensile strength of full-size threaded fasteners, wedge tensile strength of full-size threaded fasteners, and chemistry. Proficiency testing will be conducted twice annually for each of these areas of testing.

NVLAP may expand its requirements for proficiency testing to include other test methods in the major areas of testing.

A proficiency test will use statistical and graphical techniques to examine the performance of each laboratory based on the results obtained on paired test samples. After analyzing the results for each individual sample and then plotting each laboratory's results on a Youden two-sample plot, a simultaneous analysis is performed. In this last step, a 95% control ellipse is drawn such that 95% of the time, a randomly selected laboratory is included in the ellipse.

If a laboratory exceeds the critical limit on either of the two samples, it will fail the simultaneous analysis. Also, a laboratory that does not exceed the critical value for an individual sample can still fall outside the control ellipse if its results are inconsistent. This critical value, which sets the lower and upper limits for extreme data, will vary depending upon the number of participants in a given proficiency test.

Submitted results which are incomplete or which fall outside the 99% confidence level will be considered as failing.

**(7)** If an accredited laboratory fails a proficiency test, it must do the following in order to maintain its accreditation:

> **(i)** Provide, within 30 days of notification of failure, detailed, written documentation to NVLAP, that includes an analysis of why the laboratory failed each part of the test, and what corrective actions it has taken (analyst training, revised procedures, quality assurance

activities, etc.) to resolve its analytical problems so as to avoid similar errors in the future. Documented evidence that the corrective actions have been effectively implemented is required.

(ii) Participate successfully in the next round of proficiency testing.

(8) If a laboratory fails the same type of proficiency testing twice in succession or generally exhibits an erratic pattern in testing, NVLAP will review all current and previous proficiency testing results and advise the laboratory on what actions must be taken to correct the deficiency. Failure to correct the deficiency may result in suspension of accreditation. In some cases, in order to regain accreditation, the laboratory shall undergo a complete on-site assessment to determine the cause of the deficiencies, and to determine that effective corrective actions have been implemented. The laboratory shall provide NVLAP with documentation within 30 days of the assessment, adequately demonstrating that the deficiencies noted by the assessor have been satisfactorily resolved. Failure to perform fully satisfactorily in the on-site assessment will result in accreditation remaining suspended.

(9) The full cost of any on-site assessment shall be paid in advance by the laboratory. NVLAP staff will make every effort to expedite these extraordinary assessments to give a laboratory every reasonable opportunity to demonstrate competence to perform the test method and regain accreditation.

(10) Failure to participate in a round of proficiency testing will result in **immediate suspension of accreditation**, and the laboratory shall successfully participate in the next regularly scheduled round in order to have its accreditation reinstated.

**Sec. 285.23 Granting and renewing accreditation**

Laboratories granted NVLAP accreditation are provided with two documents: a Certificate of Accreditation and a Scope of Accreditation. Samples of these accreditation documents for the Fasteners and Metals program are shown in Appendix A. Note that the certificate states that the criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987).

**Sec. 285.33 Criteria for accreditation**

(c) **Quality system, audit and review**

(1) The laboratory shall define and document quality objectives for obtaining accurate and precise analytical data. These objectives shall be the benchmark by which the laboratory management assesses overall and individual performance.

(2) Under its quality system, the laboratory shall develop and implement procedures covering all the technical requirements of this handbook. A laboratory analyst shall be able to obtain enough information from the laboratory's quality documentation to perform analyses in the absence of the laboratory manager. Periodic reviews of the quality system shall reflect adherence to NVLAP requirements and the laboratory's quality objectives. These reviews shall also reflect positive aspects of the quality system as well as deficiencies.

(3) The quality manual shall describe the laboratory's staff, facilities and equipment, test procedures, calibration procedures, sample custody and handling procedures and test report format and procedures. The quality system documentation shall contain:

- specific records (or reference to records) of calibration tests, samples received and their locations, and test reports that have been issued;
- schedules for routine quality assurance checks such as calibration;
- filled-in examples of all standardized forms used in the laboratory; and
- procedures for storage and retrieval of records.

(4) The laboratory's quality assurance checks shall be performed routinely, covering all time periods, sample types, instruments, tasks and personnel. The selection of samples for quality assurance checks shall be semirandom and, when possible, the specific checks on personnel performance shall be executed without their prior knowledge. A disproportionate number of analyses shall not be performed prior to internal or external audits. Quality assurance activities

shall not be postponed during periods of heavy work loads.

(5) The laboratory shall maintain and summarize all of the quality assurance activities on a frequent enough basis to detect problems.

(6) Laboratories seeking accreditation under the Fasteners and Metals program shall have available a copy of all references listed under Sec. 285.4 of this handbook.

**(d) Personnel**

(1) Employees shall be aware of the extent of their area of responsibility. This information shall be available in the required job descriptions found in the quality documentation and individual files.

(2) The laboratory shall have a written description of its training program including its criteria for successful completion. The laboratory shall establish and document performance criteria to determine when a new analyst is qualified for working independently.

(3) Analysts, technicians, and technical supervisors shall participate in an appropriate form of continuing education, such as formal coursework, in-house education, and scientific or technical meetings, and have access to journals that describe advances in the field of testing.

(4) Analyst proficiency is important to providing reliable data. All analysts shall be tested routinely to evaluate their performance. Test results shall be recorded in the personnel folder or equivalent of each staff member, and be available during NVLAP on-site assessments. Testing shall be frequent enough to ensure quality analyses. Problems shall be discussed with the analyst, and corrected according to documented procedures. Subsequent quality assurance tests shall determine whether the problem has been corrected. The laboratory shall ensure the quality of analyses while the problem is being corrected. All corrective actions shall be documented in quality assurance summaries, periodic laboratory audits, and individual analyst's files.

(5) The laboratory shall be organized so that staff members are not subjected to undue pressure or inducement that might influence their judgment or results of their work. The laboratory shall be able to demonstrate that the sample work load required for each analyst is consistent with accurate and precise analytical measurement.

(6) The laboratory will be responsible for demonstrating its competence to analyze samples following the practice outlined in its quality documentation. Any staff member involved in the analysis of samples will be responsible for demonstrating their competence as required during an on-site assessment.

**(e) Accommodation and environment**

(See NIST Handbook 150.)

**(f) Equipment and reference materials**

(1) All equipment shall be properly maintained to ensure protection from corrosion and other causes of deterioration. Instructions for proper maintenance of equipment which requires periodic maintenance must be available. Any equipment or component thereof which has been subjected to overloading or mishandling, gives suspect results, or has been shown by calibration or otherwise to be defective, must be taken out of service and clearly labeled until it has been repaired. When placed back in service, this equipment must be shown by test or calibration to be performing its functions satisfactorily.

(2) Where available, the laboratory shall have reference materials and any associated certificates for evaluation of personnel and calibration of equipment.

(3) The laboratory shall maintain procedures for ensuring that automated test systems function properly and are used properly.

**(g) Measurement traceability and calibration**

(1) The laboratory's calibrations may be performed by properly trained staff using calibrated standards traceable to NIST or by using a NVLAP-accredited calibration laboratory. All calibrations and characterizations must be done against reference standards that are traceable to national standards maintained by NIST or by a foreign national

standards authority that issues reference or calibration materials. It is the responsibility of the laboratory seeking accreditation to determine that, where appropriate, calibration services use reference standards traceable to NIST or to a foreign national standards authority.

**(2)** Calibration certificates and records and evidence of the traceability of the reference standards used must be retained and made available for an assessor's inspection during the on-site visit. The calibration certificate should indicate uncertainty or accuracy tolerance limits, and traceability of reference standards. If calibration is performed by the laboratory, the standard metrological procedures used, the environmental conditions, and the measurement uncertainty must be documented. Certificates are required for calibration performed by outside services; they are not required for all testing equipment.

The records for each calibration and test shall contain sufficient information to permit their repetition. The records shall include the identity of personnel involved in sampling, preparation, calibration or testing.

**(3)** In addition to the information specified in NIST Handbook 150, Sec. 285.33(f)(4), testing equipment or verification records shall include the following:

**(i)** notation of all equipment variables requiring verification;

**(ii)** the range of verification;

**(iii)** the resolution of the instrument and its allowable error;

**(iv)** identity of the laboratory individual or external service responsible for calibration; and

**(v)** source of reference standard and traceability.

**(h) Calibration and test methods**

**(1)** Laboratories shall use standards and specifications which are published by a consensus standards organization or by a government agency in the areas of chemical analysis, dimensional inspection, mechanical and physical testing and inspection, metallography, and nondestructive inspection. The laboratory must have a copy of all standards, test methods, or specifications for which it seeks accreditation.

**(2)** Testing conducted in the Fasteners and Metals program is divided into five major areas of testing:

**(i)** mechanical and physical testing and inspection;

**(ii)** metallography;

**(iii)** nondestructive inspection;

**(iv)** dimensional inspection; and

**(v)** chemical analysis.

Each of these major areas is further divided into test groups with the mechanical and physical testing area further divided into subgroups. Individual standards, test methods, and specifications fall under the test groups or subgroups.

A breakdown of the five major areas is provided in Appendix E.

**(3)** The laboratory shall conform in all respects with the standard, test method, or specification except when a departure becomes necessary for technical reasons. Laboratories utilizing departures from a test method shall have written procedures detailing how the analysis is conducted. These procedures shall include criteria to determine when such departures are warranted. The laboratory shall have data to demonstrate that departures do not detract from the expected precision and accuracy of a measurement. Departures shall be acceptable to the client.

**(4)** Laboratories will be granted accreditation only for the standards, test methods, or specifications for which they apply and are competent to perform under NVLAP criteria.

**(5)** Where a standard, test method, or specification does not adequately cover all aspects of testing (i.e., sampling, sample preparation, etc.) the laboratory shall have

written procedures to address the necessary processes.

**(i) Handling of calibration and test items**

**(1)** The laboratory shall have written procedures covering all aspects of receipt, handling and storage of test items. The log-in system shall include documentation of the date of receipt, identity of the client, unique identification for the sample, condition of the samples, and the acceptance or rejection of the samples. The laboratory shall have written criteria for acceptance or rejection of samples.

**(2)** The laboratory shall have a chain-of-custody system that documents the following information:

**(i)** location of the sample;

**(ii)** personnel who have handled or worked with the sample; and

**(iii)** what has been done to the sample.

The system for identifying samples to be tested must remain in force from the date of receipt of the item to the date of its disposal, either through documents or through marking, to ensure that there is no confusion regarding the identity of the samples and the results of the measurements.

**(j) Records** (see Specific Operations Checklist)

Records may be kept in hard copy or computer form (with an adequate back-up system), but they shall be readily accessible and secure. The period of retention shall be 5 years, unless a longer period is required by the client, regulation, or the laboratory's own procedures. Procedures for storage and retrieval of records must be documented and maintained in the laboratory's quality system documentation. Records shall be stored in a logical fashion allowing retrieval within one working day.

**(k) Certificates and reports**

**(1)** Test reports issued under the requirements of the Fastener Quality Act shall be in English or be translated into English, signed by an approved signatory, and be protected by a tamper-resistant system. In addition to the requirements found in Sec. 285.33(k) of NIST Handbook 150, the test report shall also include the following information:

**(i)** Fastener description, including:
- Manufacturer (name and address);
- Product family (screw, nut, bolt, washer, or stud), drive and/or head configurations as applicable;
- Date of manufacture;
- Head markings (describe or draw manufacturer's recorded insignia and grade identification or property class symbols);
- Nominal dimensions (diameter; length of bolt, screw or stud; thickness of load bearing washer or nut); thread form and class of fit;
- Product standard and specification related to the laboratory in writing by the manufacturer, importer or distributor;
- Lot number and other numbers as appropriate;
- Specification and grade of material;
- Coating material and standard and specification, if applicable.

**(ii)** Sampling information:
- Standard or reference for sampling scheme;
- Production lot size and the number sampled and tested;
- Name and affiliation of person performing the lot sampling.

**(iii)** Test results:
- Actual tests required by standard and specification;
- Test results for each sample;
- All deviations from the test method;
- All other items required on test reports according to the test method;
- Where the report contains results of tests performed by subcontractors, these results shall be clearly identified along with the name of the laboratory and accreditation information listed in item (v) of this section.
- A statement that the samples tested either conform or do not conform to the fastener standard and specification and explanation of any

nonconformance, except as provided for in sections 280.14 and 280.15 of 15 CFR Part 280.

**(iv)** Name, title and signature of Approved Signatory accepting technical responsibility for the tests and test report.

**(v)** The name of the body which accredited the laboratory (i.e., National Voluntary Laboratory Accreditation Program) for the specific tests performed which are the subject of the report, NVLAP Lab Code assigned to the laboratory, and the expiration of accreditation. [**Note:** NVLAP procedures must be followed when referencing the term *NVLAP* and using the NVLAP logo; see NIST Handbook 150, Sec. 285.8.]

**(2)** In addition to the requirements found in Sec. 285.33(k) of NIST Handbook 150, for alternative chemical tests carried out under the Fastener Quality Act, the laboratory shall provide to the fastener manufacturer, either directly or through the metal manufacturer, a written inspection and testing report containing the following information:

**(i)** Coil or heat number of metal being tested.

**(ii)** Test results:

- Actual tests required by specification;
- Test results for each sample;
- All deviations from the test method;
- All other items required on test reports according to the test method;
- Where the report contains results of tests performed by subcontractors, these results shall be clearly identified along with the name of the laboratory and accreditation information listed in item (iv) of this section;
- A statement that the samples tested either conform or do not conform to the metal specifications or standards and explanation of any nonconformance.

**(iii)** Name, title and signature of Approved Signatory accepting technical responsibility for the tests and test report.

**(iv)** The name of the body which accredited the laboratory (i.e., National Voluntary Laboratory Accreditation Program) for the specific tests performed which are the subject of the report, NVLAP Lab Code assigned to the laboratory, and the expiration of accreditation. [**Note:** NVLAP procedures must be followed when referencing the term *NVLAP* and using the NVLAP logo; see NIST Handbook 150, Sec. 285.8.]

**(3)** The laboratory shall issue corrections or additions to a test report only by a further document suitably marked; e.g., "Supplement to test report serial number . . . ." This document must specify which test result is in question, the content of the result, the explanation of the result, and the reason for acceptance of the result.

**(l) Subcontracting of calibration or testing**

**(1)** Whenever a laboratory performs work under the provisions of the Fastener Quality Act, it is implied that the report reflects work performed, and results obtained, by the personnel, equipment, and procedures of that laboratory. However, in some cases a laboratory may require the use of another facility due to equipment failure, need for specialized equipment, work overload, or to perform tests outside the laboratory's own scope of accreditation.

**(2)** Whenever a laboratory subcontracts to another laboratory the performance of any test or portion of a test it must:

**(i)** place the work with another laboratory accredited under the provisions of the Fastener Quality Act;

**(ii)** inform the client, before the fact, that subcontracting will be necessary; and

**(iii)** clearly identify in its records, and in the report to the client, specifically which test method(s) or portions of a test method(s) were performed by the

accredited laboratory and which were performed by the subcontractor.

**(m) Outside support services and supplies**

(See NIST Handbook 150.)

**(n) Complaints**

(See NIST Handbook 150.)

# APPENDIX A

# SAMPLE ACCREDITATION DOCUMENTS

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC GUIDE 25:1990
ISO 9002:1987

# Certificate of Accreditation

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

## LABORATORY, INC.
ANYTOWN, USA

*is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:*

## FASTENERS AND METALS

**December 31, 19XX**
*Effective through*

*For the National Institute of Standards and Technology*

NVLAP-01C (11-95)

**NVLAP LAB CODE: 100000-0**

National Institute of Standards and Technology **NVLAP®** National Voluntary Laboratory Accreditation Program

ISO/IEC GUIDE 25:1990
ISO 9002:1987

# Scope of Accreditation



**FASTENERS AND METALS** **NVLAP LAB CODE 100000-0**

**LABORATORY, INC.**
1 Main Street
Anytown, USA 00000
John Doe Phone: 301-555-1212

| *NVLAP Code* | *Designation* | *Short Title* |
|---|---|---|
| **MECHANICAL AND PHYSICAL TESTING AND INSPECTION** | | |
| **Corrosion** | | |
| ***Humidity Testing of Fasteners*** | | |
| 21/XXXX | MIL-STD-753C | Corrosion—Resistant Steel Parts |
| **METALLOGRAPHY** | | |
| **Determination of Grain Size of Fasteners** | | |
| 21/XXXX | SAE J418 | Grain Size Determination of Steels |
| **CHEMICAL ANALYSIS** | | |
| **Solution Chemical Analysis** | | |
| 21/XXXX | ASTM E1473-92 | Chemical Analysis of Nickel, Cobalt and High-Temperature Alloys |

December 31, 19XX
*Effective through*

*For the National Institute of Standards and Technology*

NVLAP-01S (11-95)

# APPENDIX B

# GENERAL OPERATIONS CHECKLIST

# GENERAL OPERATIONS CHECKLIST

**Instructions to the Assessor:** This checklist addresses general accreditation criteria prescribed in applicable sections of NIST Handbook 150, *NVLAP Procedures and General Requirements*.

This checklist follows and is numbered to correspond to the *NVLAP Procedures and General Requirements*, Subsection 285.33. The numbers in square brackets identify related checklist items. A small black triangle appears in the left-hand margin of selected lines of text throughout this checklist; the marked text applies only to the Calibration Laboratory Accreditation Program (LAP).

Place an "X" beside each checklist item which represents a deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments in this list or on the attached comment sheets. Place a check beside all other items you observed or verified at the laboratory.

## SEC. 285.33 CRITERIA FOR ACCREDITATION

(b) ***Organization and management***

(1) The laboratory shall be:

_____ (i) legally identifiable;

Legal name of laboratory ownership: _____

(ii) organized and shall operate in such a way that its permanent, temporary and mobile facilities meet the NVLAP requirements [see also (b)(2)(i), (c)(2)(ii)];

_____ (iii) properly identified on the NVLAP Application.

(2) The laboratory shall:

_____ (i) have managerial staff with the authority and resources needed to discharge their duties [see also (b)(1)(ii), (c)(2)(ii)];

_____ (ii) have policies to ensure that its personnel are free from any commercial, financial and other pressures which might adversely affect the quality of their work;

_____ (iii) be organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

_____ (iv) specify and document the responsibility, authority and interrelation of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

_____ (v) provide supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results. The ratio of supervisory to non-supervisory personnel shall be such as to ensure adequate supervision;

_____ (vi) have a technical manager (however named) who has overall responsibility for the technical operations;

Name of person: _____

_____ (vii) have a quality manager (however named) who has responsibility for the quality system and its implementation. The quality manager shall have direct access to the highest level of management at which decisions are taken on laboratory policy or resources, and to the technical manager. In some laboratories, the quality manager may also be the technical manager or deputy technical manager;

Name of person: _____

_____ (viii) nominate deputy(ies) in case of absence of the technical or quality manager;

Name(s): _____

_____ (ix) have documented policy and procedures to ensure the protection of clients' confidential information and proprietary rights [see also (c)(2)(xviii)];

_____ (x) where appropriate, participate in interlaboratory comparisons and proficiency testing programs [see also (c)(2)(xiv), (c)(6)(ii), (g)(3)];

_____ (xi) have documented policy and procedures to ensure that its clients are served with impartiality and integrity.

(c) ***Quality system, audit and review***

(1) The laboratory shall:

_____ (i) have an established and maintained quality system appropriate to the type, range and volume of calibration and testing activities it undertakes;

_____ (ii) have the elements of the quality system documented;

_____ (iii) ensure that the quality documentation is available for use by the laboratory personnel;

_____ (iv) define and document its policies and objectives for, and its commitment to, good laboratory practice and quality of calibration or testing services;

_____ (v) have the laboratory management which ensures that these policies and objectives are documented in a quality manual and communicated to, understood, and implemented by all laboratory personnel concerned;

_____ (vi) ensure that the quality manual is maintained current under the responsibility of the quality manager [see also (c)(2)(iv)].

Date of quality manual: _____

Date of latest update: _____

(2) The quality manual, and related quality documentation, shall state the laboratory's policies and operational procedures established in order to meet the NVLAP requirements. The quality manual and related quality documentation shall contain:

_____ (i) a quality policy statement, including objectives and commitments, by top management;

_____ (ii) the organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

_____ (iii) the relations between management, technical operations, support services and the quality system;

_____ (iv) procedures for control and maintenance of documentation [see also (c)(1)(vi), (j)(1)];

_____ (v) job descriptions of key staff and reference to the job descriptions of other staff;

_____ (vi) identification of the laboratory's approved signatories (list here or in the comments section): _____

_____

_____ (vii) the laboratory's procedures for achieving traceability of measurements;

_____ (viii) the laboratory's scope of calibrations and/or tests;

_____ (ix) written procedures for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

_____ (x) reference to the calibration, verification and/or test procedures used;

_____ (xi) procedures for handling calibration and test items;

_____ (xii) reference to the major equipment and reference measurement standards used;

_____ (xiii) reference to procedures for calibration, verification and maintenance of equipment;

_____ (xiv) reference to verification practices including interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes [see also (b)(2)(x), (c)(6)(ii), (g)(3)];

(xv) procedures to be followed for feedback and corrective action whenever:

_____ a) testing discrepancies are detected, or

_____ b) departures from documented policies and procedures occur;

_____ (xvi) the laboratory management policies for departures from documented policies and procedures or from standard specifications;

_____ (xvii) procedures for dealing with complaints [see also (n)];

_____ (xviii) procedures for protecting confidentiality and proprietary rights [see also (b)(2)(ix)];

_____ (xix) procedures for audit and review;

_____ (xx) a description of the laboratory's policy regarding the use of the NVLAP logo;

▸ _____ (xxi) a statement of the laboratory's policy for establishing and changing
▸ calibration intervals for equipment it controls; and

► _____ (xxii) a statement of the laboratory's policy concerning the technique(s) to be used
► for determining measurement uncertainty and calibration/verification
► adequacy.

_____ (3) The laboratory shall arrange for audits of its activities at appropriate intervals to verify that its operations continue to comply with the requirements of the quality system. Such audits shall be carried out by trained and qualified staff who are, wherever possible, independent of the activity to be audited. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibration or test results, the laboratory shall take immediate corrective action and shall immediately notify, in writing, any client whose work may have been affected.

The audits shall be objective and be conducted internally or on contract. The audits shall include both general criteria (documents, records and policies) and technical compliance (test methods and practices and calibration procedures).

_____ (4) The quality system adopted to satisfy the NVLAP requirements shall be reviewed at least once a year by the management to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements.

_____ (5) All audit and review findings and any corrective actions that arise from them shall be documented. The person responsible for quality shall ensure that these actions are discharged within the agreed timescale.

(6) In addition to periodic audits the laboratory shall ensure the quality of results provided to clients by implementing checks. These checks shall be reviewed and shall include, as appropriate, but not be limited to:

_____ (i) internal quality control plans, such as control charts and other available statistical techniques;

**NOTE:** Measurement assurance techniques are acceptable means to control the measurement process and consistently produce the highest quality measurements.

_____ (ii) participation in proficiency testing or other interlaboratory comparisons [see also (b)(2)(x), (c)(2)(xiv), (g)(3)];

_____ (iii) regular use of certified reference materials and/or in-house quality control using secondary reference materials;

_____ (iv) replicate testings using the same or different methods;

_____ (v) retesting of retained items;

_____ (vi) correlation of results for different characteristics of an item.

(d) ***Personnel*** [see also (c)(2)(v)]

_____ (1) The testing laboratory shall have sufficient personnel, having the necessary education, training, technical knowledge and experience for their assigned functions.

_____ (2) The testing laboratory shall ensure that the training of its personnel is kept up-to-date.

_____ (3) Records on the relevant qualifications, training, skills and experience of the technical personnel shall be maintained by the laboratory.

(e) ***Accommodation (facilities) and environment*** [see also (i)(3)]

_____ (1) Laboratory accommodation, calibration and test areas, energy sources, lighting, heating and ventilation shall be such as to facilitate proper performance of calibrations or tests.

**NOTE:** Laboratory design will be, to the maximum extent practical, in accordance with the guidelines found in the NCSL Recommended Practice #7, *Laboratory Design*, July 25, 1993.

_____ (2) The environment in which these activities are undertaken shall not invalidate the results or adversely affect the required accuracy of measurement. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

**NOTE:** It is expected that environments which do not meet generally accepted norms, such as those found in NCSL Recommended Practice #7, yet which exhibit the stability required to apply necessary correction factors, will be specified by the laboratory for the purpose of assessment of compliance with its own procedures to achieve its stated uncertainties.

_____ (3) The laboratory shall provide facilities for the effective monitoring, control and recording of environmental conditions as appropriate. Due attention shall be paid, for example, to biological sterility, dust, electromagnetic interference, humidity, voltage, temperature, and sound and vibration levels, as appropriate to the calibrations or tests concerned.

_____ (4) There shall be effective separation between neighboring areas when the activities therein are incompatible.

_____ (5) Access to and use of all areas affecting the quality of these activities shall be defined and controlled.

_____ (6) Adequate measures shall be taken to ensure good housekeeping in the laboratory.

**NOTE:** While it is the laboratory's responsibility to comply with relevant health and safety requirements, this is outside the scope of this assessment.

(f) ***Equipment and reference materials***

(1) The laboratory shall:

_____ (i) be furnished with all items of equipment (including hardware, software, and reference materials) required for the correct performance of calibrations and tests;

_____ (ii) in those cases where the laboratory needs to use equipment outside its permanent control, including rented, leased and client-owned equipment, ensure that the relevant NVLAP requirements are met.

_____ (2) All equipment shall be properly maintained. Maintenance procedures shall be documented. Any item of the equipment which has been subjected to overloading or mishandling, or which gives suspect results, or has been shown by verification or otherwise to be defective, shall be taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

_____ (3) Each item of equipment including reference materials shall, when appropriate, be labelled, marked or otherwise identified to indicate its calibration status.

_____ (4) Records shall be maintained of each item of equipment and all reference materials significant to the calibrations or tests performed. The records shall include:

_____ (i) the name of the item of equipment, software or reference material;

_____ (ii) the manufacturer's name, type identification, and serial number or other unique identification;

_____ (iii) date received and date placed in service;

**NOTE:** For initial accreditation, the date received and the date placed in service are not considered mandatory requirements for inclusion in laboratory records, although this is encouraged as good laboratory practice.

_____ (iv) current location, where appropriate;

_____ (v) condition when received (e.g., new, used, reconditioned);

_____ (vi) copy of the manufacturer's instructions, where available;

_____ (vii) dates and results of calibrations and/or verifications and date of next calibration and/or verification;

_____ (viii) details of maintenance carried out to date and planned for the future;

_____ (ix) history of any damage, malfunction, modification or repair;

► _____ (x) measured value observed for each parameter found to be out of tolerance
► during calibration/verification.

(g) ***Measurement traceability and calibration***

_____ (1) All measuring and testing equipment having an effect on the accuracy or validity of calibrations or tests shall be calibrated and/or verified before being put into service. The laboratory shall have an established program for the calibration and verification of its measuring and test equipment. The program will ensure the recall or removal from service of any standard or equipment which has exceeded its calibration interval or is otherwise judged to be unreliable.

_____ (2) The overall program of calibration and/or verification and validation of equipment shall be designed and operated so as to ensure that, wherever applicable, measurements made by the laboratory are traceable to national standards of measurement where available. Calibration certificates shall, wherever applicable, indicate the traceability to national standards of measurement and shall provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification.

**NOTE:** Traceability to national standards includes traceability to standards maintained or defined at national laboratories in foreign countries where applicable. In these cases, traceability is achieved via international standards. This includes intrinsic standards of measurement where available.

Where applicable, the methodology of the *Guide to the expression of uncertainty in measurement*: 1993, shall be used as the basis for expression of uncertainty of the measurement. NIST Technical Note 1297; January 1993, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, is a practical application document written around the *Guide to the expression of uncertainty in measurement*. Where detailed procedures are not used to quantify and combine uncertainties (i.e., use of test accuracy ratio concepts), the sources of uncertainty shall be tabulated and demonstrated to be acceptable for the measurement undertaken.

**NOTE:** A significant number of intrinsic standards, such as the Josephson Array Voltage Standard and the Iodine-Stabilized Helium-Neon Laser Length Standard, have been developed and are now being used by many national standards laboratories and some industrial laboratories. These standards are based on well-characterized laws of physics, fundamental constants of nature, or invariant properties of materials, and make ideal stable, precise, and accurate measurement standards if properly designed, characterized, operated, monitored and maintained. Where intrinsic standards are used, the laboratory should demonstrate by measurement assurance techniques, interlaboratory comparisons, or other suitable means, that its intrinsic standard measurement results are correlated with those of national or international standards.

_____ (3) Where traceability to national standards of measurement is not applicable, the laboratory shall provide satisfactory evidence of correlation of results, for example by participation in a suitable program of interlaboratory comparisons or proficiency testing [see also (b)(2)(x), (c)(2)(xiv), (c)(6)(ii)].

**NOTE:** Traceability requirements may also be satisfied by:

(i) internationally accepted standards in the field concerned;

(ii) suitable reference materials;

(iii) ratio or reciprocity measurements; or

(iv) mutual consent standards which are clearly specified and mutually agreed upon by all parties concerned.

_____ (4) Reference standards of measurement held by the laboratory shall be used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated.

_____ (5) Reference standards of measurement shall be calibrated by a body that can provide traceability to a national standard of measurement. There shall be a program of calibration and verification for reference standards.

_____ (6) Where relevant, reference standards and measuring and testing equipment shall be subjected to in-service checks between calibrations and verifications.

_____ (7) Reference materials shall, where possible, be traceable to national or international standards of measurement, or to national or international standard reference materials.

(h) ***Calibration and test methods***

_____ (1) The laboratory shall have documented instructions on the use and operation of all relevant equipment, on the handling and preparation of items and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests. All instructions, standards, manuals and reference data relevant to the work of the laboratory shall be maintained up-to-date and be readily available to the staff.

_____ (2) The laboratory shall use appropriate methods and procedures for all calibrations and tests and related activities within its responsibility (including sampling, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of calibration and/or test data). They shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

**NOTES:**

(i) Calibration procedures shall contain the required range and tolerance or uncertainty of each item or unit parameter being calibrated or verified. In addition, the procedures shall contain the generic description of the measurement standards and equipment needed with the required parameter, range, tolerances or uncertainties, and specifications for performing the measurement of the calibration or verification, and/or representative types (manufacturer, model, option) that are capable of meeting the generic description for the measurement standards. The procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations/verifications concerned.

(ii) The laboratory shall ensure that the calibration uncertainties are sufficiently small so that the adequacy of the measurement is not affected. Well-defined and documented measurement assurance techniques or uncertainty analyses may be used to verify the adequacy of a measurement process. If such techniques are not used, then the collective uncertainty of the measurement standards shall not exceed 25% of the acceptable tolerance (e.g., manufacturer's specification) for each characteristic of the measuring and test equipment being calibrated or verified.

_____ (3) Where methods are not specified, the laboratory shall, wherever possible, select methods that have been published in international or national standards, those published by reputable technical organizations or in relevant scientific texts or journals.

_____ (4) Where it is necessary to employ methods that have not been established as standard, these shall be subject to agreement with the client, be fully documented and validated, and be available to the client and other recipients of the relevant reports [see also (k)(2)(x)].

_____ (5) Where sampling is carried out as part of the test method, the laboratory shall use documented procedures and appropriate statistical techniques to select samples [see also (k)(2)(ix)].

_____ (6) Calculations and data transfers shall be subject to appropriate checks.

(7) Where computers or automated equipment are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of calibration or test data, the laboratory shall have written procedures which ensure that:

_____ (i) the NVLAP requirements are complied with;

_____ (ii) computer software, computers or automated equipment is documented and adequate for use;

_____ (iii) procedures are established and implemented for protecting the integrity of data; such procedures shall include, but not be limited to, integrity of data entry or capture, data storage, data transmission and data processing;

_____ (iv) computer and automated equipment is maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data [see also (f)(1)];

_____ (v) it establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

_____ (8) Documented procedures shall exist for the purchase, reception and storage of consumable materials used for the technical operations of the laboratory [see also (m)(2)].

(i) ***Handling of calibration and test items***

_____ (1) The laboratory shall have a documented system for uniquely identifying the items to be calibrated or tested, to ensure that there can be no confusion regarding the identity of such items at any time [see also (k)(2)(v)].

_____ (2) Upon receipt, the condition of the calibration or test item, including any abnormalities or departures from standard condition as prescribed in the relevant calibration or test method, shall be recorded. Where there is any doubt as to the item's suitability for calibration or test, where the item does not conform to the description provided, or where the calibration or test required is not fully specified, the laboratory shall consult the client for further instruction before proceeding. The laboratory shall establish whether the item has received all necessary preparation, or whether the client requires preparation to be undertaken or arranged by the laboratory.

_____ (3) The laboratory shall have documented procedures and appropriate facilities to avoid deterioration or damage to the calibration or test item, during storage, handling, preparation, and calibration or test; any relevant instructions provided with the item shall be followed. Where items have to be stored or conditioned under specific environmental conditions, these conditions shall be maintained, monitored and recorded where necessary. Where a calibration or test item or portion of an item is to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory shall have storage and security arrangements that protect the condition and integrity of the secured items or portions concerned [see also (e)].

_____ (4) The laboratory shall have documented procedures for the receipt, retention or safe disposal of calibration or test items, including all provisions necessary to protect the integrity of the laboratory.

_____ (5) Tamper-resistant seals shall be affixed to operator-accessible controls or adjustments on measurement standards or measuring and test equipment which, if moved, will invalidate the calibration. The laboratory's calibration system shall provide instructions for the use of such seals and for the disposition of equipment with damaged or broken seals.

**NOTE:** Tamper-resistant seals are sometimes affixed to equipment to prevent unauthorized access to areas where adjustments or critical components are located.

**(j) *Records***

_____ (1) The laboratory shall maintain a record system to suit its particular circumstances and comply with any applicable regulations. It shall retain on record all original observations, calculations and derived data, calibration records and a copy of the calibration certificate, test certificate or test report for an appropriate period. The records for each calibration and test shall contain sufficient information to permit their repetition. The records shall include the identity of personnel involved in sampling, preparation, calibration or testing [see also (c)(2)(iv)].

▸ **EXCEPTION:** The retention of all original observations, calculations, and
▸ derived data in the calibration record system is not a mandatory requirement
▸ for calibration laboratories, although it is encouraged as good laboratory
▸ practice.

_____ (2) All records (including those listed in (f)(4) pertaining to calibration and test equipment), certificates and reports shall be safely stored, held secure and in confidence to the client [see also (b)(2)(ix), (c)(2)(xviii)].

**NOTE:** The period of retention shall be specified in the quality manual.

Record retention time specified: _____

(k) ***Certificates and reports***

_____ (1) The results of each calibration, test, or series of calibrations or tests carried out by the laboratory shall be reported accurately, clearly, unambiguously and objectively, in accordance with any instructions in the calibration or test methods. The results should normally be reported in a calibration certificate, test report or test certificate and should include all the information necessary for the interpretation of the calibration or test results and all information required by the method used [see also (k)(4)(i)].

▸ **NOTE:** It is recognized that the results of each calibration do not always
▸ result in the production of a calibration certificate or report. Whenever a
▸ certificate or report is produced, the above requirements shall be met.

(2) Each certificate or report shall include at least the following information:

_____ (i) a title, e.g., "Calibration Certificate," "Test Report" or "Test Certificate";

_____ (ii) name and address of laboratory, and location where the calibration or test was carried out if different from the address of the laboratory;

_____ (iii) unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

_____ (iv) name and address of client, where appropriate;

_____ (v) description and unambiguous identification of the item calibrated or tested [see also (i)(1)];

_____ (vi) characterization and condition of the calibration or test item;

_____ (vii) date of receipt of calibration or test item and date(s) of performance of calibration or test, where appropriate;

▸ **EXCEPTION:** Although it is encouraged as good laboratory practice, the
▸ requirement for inclusion of the date received is not mandatory for calibration
▸ laboratories.

_____ (viii) identification of the calibration or test method used, or unambiguous description of any non-standard method used;

_____ (ix) reference to sampling procedure, where relevant [see also (h)(5)];

_____ (x) any deviations from, additions to or exclusions from the calibration or test method, and any other information relevant to a specific calibration or test, such as environmental conditions [see also (c)(2)(xv), (h)(4)];

_____ (xi) measurements, examinations and derived results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified;

_____ (xii) a statement of the estimated uncertainty of the calibration or test result, where relevant;

_____ (xiii) a signature and title, or an equivalent identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue [see also (c)(2)(vi)];

_____ (xiv) where relevant, a statement to the effect that the results relate only to the items calibrated or tested;

_____ (xv) a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

_____ (xvi) a statement that the report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government;

_____ (xvii) the signature of an approved signatory for all test and calibration reports endorsed with the NVLAP logo;

▸ _____ (xviii) special limitations of use; and

▸ _____ (xix) traceability statement.

_____ (3) Where the certificate or report contains results of calibrations or tests performed by subcontractors, these results shall be clearly identified [see also (l)].

_____ (4) Particular care and attention shall be paid to the arrangement of the certificate or report, especially with regard to presentation of the calibration or test data and ease of assimilation by the reader. The format shall be carefully and specifically designed for each type of calibration or test carried out, but the headings shall be standardized as far as possible [see also (k)(1)].

_____ (5) Material amendments to a calibration certificate, test report or test certificate after issue shall be made only in the form of a further document, or data transfer including the statement "Supplement to Calibration Certificate (or Test Report or Test Certificate), serial number ... (or as otherwise identified)," or equivalent form of wording. Such amendments shall meet all the relevant requirements of item (j).

_____ (6) The laboratory shall notify clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report, or test certificate or amendment to a report or certificate.

**NOTE:** Such notification shall quantify the magnitude of error created in the calibration results. The laboratory shall notify customers promptly, in writing, of any customer's measuring and test equipment found significantly out of tolerance during the calibration/verification process. Measurement data shall be reported so that appropriate action can be taken.

_____ (7) The laboratory shall ensure that, where clients require transmission of calibration or test results by telephone, telex, facsimile or other electronic or electromagnetic means, staff will follow documented procedures that ensure that the NVLAP requirements are met and that confidentiality is preserved.

_____ (8) Whenever a laboratory accredited by NVLAP issues a calibration or test report which contains data covered by the accreditation and also data not covered by the accreditation, it must clearly identify in its records, and in the report to the client, specifically which calibration or test method(s), or portion of a calibration or test method(s), was not covered by the accreditation. The laboratory must also inform the client, before the fact, when calibrations or tests requested are not covered by the accreditation.

NVLAP policy regarding calibration and test reports issued by an accredited laboratory, which reference the laboratory's accredited status, requires that any calibration or test report containing data from calibrations or tests which are not covered by the accreditation include:

_____ (i) a statement at the beginning of the report prominently indicating, "This report contains data which are not covered by the NVLAP accreditation"; and

_____ (ii) a clear indication of which data are not covered by the accreditation.

The laboratory must not misrepresent its accreditation. When a client requires or requests accredited services and any of the requested services are not covered by the accreditation, the client must be so advised.

(l) ***Subcontracting of calibration or testing*** [see also (k)(3)]

_____ (1) Where a laboratory subcontracts any part of the calibration or testing, this work shall be placed with a laboratory complying with these requirements. The laboratory shall ensure and be able to demonstrate that its subcontractor is competent to perform the activities in question and complies with the same criteria of competence as the laboratory in respect of the work being subcontracted. The laboratory shall advise the client in writing of its intention to subcontract any portion of the testing to another party.

_____ (2) The laboratory shall record and retain details of its investigation of the competence and compliance of its subcontractors and maintain a register of all subcontracting.

_____ (3) A NVLAP-accredited laboratory intending to subcontract testing or calibration work that will be performed and reported as meeting NVLAP procedures and criteria must:

_____ (i) have in its quality manual a subcontracting policy compatible with the NVLAP policy, with a description of the procedures for administering and implementing those actions to demonstrate the conformance and consistency of the subcontracted laboratory to perform according to NVLAP procedures;

_____ (ii) place the subcontracted work with a laboratory that maintains accreditation established by NVLAP shown by a current NVLAP Lab Code, or provide and maintain current records that demonstrate that the subcontracted laboratory is competent to perform the test(s) or calibration(s) and that it operates in a manner consistent with and in conformance to NVLAP criteria for accreditation;

_____ (iii) clearly identify in its records, and in the report to the client, exactly which data were obtained by the NVLAP-accredited laboratory and which data were obtained by the subcontractor, NVLAP-accredited or not;

_____ (iv) inform its client, before the fact, that it intends to subcontract for completion of all or a portion of the client's work; and

_____ (v) include at the beginning of the report the name, address, and contact person of the subcontracted laboratory(ies), and one of the following statements, as appropriate:

*if NVLAP-accredited*

"This report contains data which were produced by a subcontracted laboratory **ACCREDITED (NVLAP LAB CODE)** for the calibration or test methods performed"

*if not NVLAP-accredited*

"This report contains data which were produced by a subcontracted laboratory **NOT ACCREDITED** for the calibration or test methods performed."

The requirements of this section do not supersede any regulation, law, contract specification, or other related conditions which require NVLAP accreditation.

(m) ***Outside support services and supplies***

_____ (1) Where the laboratory procures outside services and supplies in support of calibrations or tests, the laboratory shall use only those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's calibrations or tests.

_____ (2) Where no independent assurance of the quality of outside support services or supplies is available, the laboratory shall have procedures to ensure that purchased equipment, materials and services comply with specified requirements. The laboratory should, wherever possible, ensure that purchased equipment and consumable materials are not used until they have been inspected, calibrated or otherwise verified as complying with any standard specifications relevant to the calibrations or tests concerned [see also (h)(8)].

_____ (3) The laboratory shall maintain records of all suppliers from whom it obtains support services or supplies required for calibrations or tests.

(n) ***Complaints*** [see also (c)(2)(xvii)]

_____ (1) The laboratory shall have documented policy and procedures for the resolution of complaints received from clients or other parties about the laboratory's activities. A record shall be maintained of all complaints and of the actions taken by the laboratory.

_____ (2) Where a complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the NVLAP requirements or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with item (c)(3).

(o) ***Measuring and test equipment (M & TE)***

**NOTE:** This section applies to the control of measuring and test equipment (M & TE) used to assure that supplies and services comply with prescribed customer requirements. It is based in large part on the requirements found in government audit standards such as MIL-STD 45662A, and is found in Part II of the ANSI/NCSL Z540-1-1994 (Draft) standard.

(1) General requirements for M & TE

_____ (i) The supplier shall establish and document a system to control the calibration/verification of M & TE.

_____ (ii) M & TE used to determine compliance with customer technical specifications shall be calibrated or verified in accordance with sections 285.33(b) through (n).

_____ (iii) The supplier shall have a program to recall for calibration or verification, or remove from service, M & TE that has exceeded its calibration interval, has broken calibration seals, or is suspected to be malfunctioning because of mishandling, misuse, or unusual results.

_____ (iv) All operations performed by the supplier in compliance with these requirements shall be subject to customer verification at unscheduled intervals.

_____ (v) The supplier shall carry out, or arrange to have carried out, periodic quality auditing of the calibration and verification system in order to ensure its continuing effective implementation and compliance with these requirements.

- Based on the results of the audits and any other relevant factors, such as customer feedback, the supplier shall review and modify the system as necessary.

-1) Plans and procedures for the audits shall be documented. The conduct of the audit and any subsequent corrective action shall also be documented.

(2) Detailed requirements for M & TE

_____ (i) Calibration system description: The supplier shall provide and maintain a written description of the calibration/verification system covering M & TE and measurement standards. The description shall be sufficient to satisfy each requirement of section 285.33(o) and any deviations shall be submitted with supporting documentation to the customer for approval.

_____ (ii) Adequacy of measurement standards: Measurement standards used by the supplier for calibrating M & TE and other measurement standards shall comply with the requirements of items (f)(1), (g)(1), and (h)(2).

_____ (iii) Environmental conditions: M & TE shall be used in an environment controlled to the extent necessary to ensure valid results. Due consideration shall be given to temperature, humidity, lighting, vibration, dust control, cleanliness, electromagnetic interference and any other factors affecting the results of measurements. Where pertinent, these factors shall be monitored and recorded and, when appropriate, correcting compensations shall be applied to measurement results.

_____ (iv) Intervals of calibration and verification: M & TE requiring calibration shall be calibrated or verified at periodic intervals established and maintained to assure acceptable reliability, where reliability is defined as the probability that M & TE will remain in-tolerance throughout the interval. Intervals shall be established for all M & TE requiring calibration unless the equipment is regularly monitored through the use of check standards in a documented measurement assurance process. Check standards must closely represent the item parameters normally tested in the process and the check standard must be verified periodically. Where intervals are used to ensure reliability, the interval setting system must be systematically applied and shall have stated reliability goals and a method of verifying that the goals are being attained. Intervals may be based on usage or time since last calibration or verification. All exemptions from periodic calibration or verification shall be documented. The recall system may provide for the temporary extension of the calibration due date for limited periods of time under specified conditions that do not unreasonably impair the satisfaction of the customer's requirements.

_____ (v) Calibration procedures: Procedures used to calibrate/verify the supplier's M & TE shall comply with the requirements of items (h)(1) and (h)(2).

_____ (vi) Out-of-tolerance conditions: If any M & TE is found to be significantly out of tolerance during the calibration/verification process, the supplier's system shall provide for notification to the user and to the supplier's quality element, if appropriate, of the out-of-tolerance condition with the associated measurement data so that appropriate action can be taken.

_____ (vii) Adequacy of calibration system: The supplier shall establish and maintain documented procedures to evaluate the adequacy of the calibration system and to ensure compliance with these requirements.

_____ (viii) Calibration sources: M & TE requiring calibration shall be calibrated or verified by laboratories that comply with sections 285.33(b) through (n).

_____ (ix) Records: These requirements shall be supported by records documenting that established schedules and procedures are followed to maintain the adequacy of all M & TE. The records for M & TE requiring calibration shall include an individual record of calibration or verification, or other means of control, providing a description or identification of the item, calibration interval, date calibrated, identification of the calibration source, calibration results (data and/or condition status) and calibration action taken (adjusted, repaired, new value assigned, derated, etc.).

_____ (x) Calibration status: M & TE shall be labeled to indicate calibration or verification status. The label shall identify specific date calibrated (day, month, year, Julian date, or equivalent) and the specific calibration due date or usage equivalent. Items not calibrated to their full capability or which have other limitations of use, shall be labeled or otherwise identified as to the limitations. When it is impractical to apply a label directly to an item, the label may be affixed to the instrument container or some other suitable means may be used to reflect calibration status. Tamper-resistant seals are affixed to operator accessible controls or adjustments which if moved will invalidate the calibration. The quality system shall provide instructions for the disposition of equipment with broken tamper-resistant seals.

_____ (xi) Control of subcontractor calibration: The supplier is responsible for assuring that the subcontractor's calibration system conforms to section 285.33 (l) to the degree necessary to assure compliance with contractual requirements. NVLAP accreditation of the subcontractor's laboratory can serve as the basis for compliance with this requirement.

_____ (xii) Storage and handling: M & TE shall be handled, stored, and transported in a manner which shall not adversely affect the calibration or condition of the equipment.

NVLAP LAB CODE: _____

## GENERAL OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

**Instructions to the Assessor:** Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

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## GENERAL OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

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# APPENDIX C

# SPECIFIC OPERATIONS CHECKLIST

NVLAP LAB CODE: [ ]

# FASTENERS AND METALS SPECIFIC OPERATIONS CHECKLIST

**Instructions to the Assessor:** This checklist addresses specific accreditation criteria prescribed in applicable sections of NIST Handbook 150-18.

Place an "X" beside any of the checklist items which represent a deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments on this list or on the comment sheet(s). Place a check beside all other items you observed or verified at the laboratory.

## 1 Organization and management

(See General Operations Checklist.)

## 2 Quality system, audit and review

_____ 2.1 The laboratory shall have the following documents available for reference:

_____ 2.1.1 NIST Handbook 150, *NVLAP Procedures and General Requirements*;
_____ 2.1.2 NIST Handbook 150-18, *NVLAP Fasteners and Metals*;
_____ 2.1.3 Fastener Quality Act, Public Law 101-592, 1990;
_____ 2.1.4 National Technology Transfer and Advancement Act, Public Law 104-113, 1995; and
_____ 2.1.5 Procedures for Implementation of the Fastener Quality Act, Title 15, Part 280 of the U.S. Code of Federal Regulations (CFR).

_____ 2.2 The laboratory's quality documentation contains procedures or instructions describing the following:

_____ 2.2.1 training of staff and quality assurance of analyst performance;
_____ 2.2.2 sample custody and handling procedures;
_____ 2.2.3 equipment maintenance and calibration; and
_____ 2.2.4 recordkeeping and generation of reports.

_____ 2.3 The laboratory shall conduct an internal audit of the laboratory not less than annually to verify that the operations of the laboratory are in compliance with its quality manual and this program.

## 3 Personnel

_____ 3.1 The laboratory shall ensure that staff members are aware of the extent of their area of responsibility.

_____ 3.2 The laboratory shall maintain documentation for each staff member which contains:

_____ 3.2.1 staff member's title and description of that job position;
_____ 3.2.2 job and quality assurance responsibilities;
_____ 3.2.3 résumé;
_____ 3.2.4 training;
_____ 3.2.5 assigned laboratory procedures and duties; and
_____ 3.2.6 results of periodic testing performance reviews.

_____ 3.3 The laboratory shall have a description of its staff training program including its criteria for successful completion.

_____ 3.4 Analysts and technical supervisors shall participate in some form of continuing education, such as formal course work, in-house education, and scientific or technical meetings, and have access to journals that describe advances in their field of testing.

**4 Accommodation (facilities) and environment**

(See General Operations Checklist.)

**5 Equipment and reference materials**

(See General Operations Checklist.)

**6 Measurement traceability and calibration**

_____ 6.1 Calibrations are performed by properly trained staff using calibrated standards traceable to NIST, or by using a NVLAP-accredited calibration laboratory.

**7 Test methods and calibration**

(See General Operations Checklist.)

**8 Handling of calibration and test items**

_____ 8.1 The laboratory shall have a sample log system used to uniquely identify the test item and document the action. The log shall include:

_____ 8.1.1 date of receipt of the test item;
_____ 8.1.2 the condition of the test item;
_____ 8.1.3 documentation of acceptance or rejection of test item, reasons for rejection;
_____ 8.1.4 a unique laboratory identification number for each test sample;
_____ 8.1.5 the client identification number, which is the number that the client (or sample taker) assigns to the test item;
_____ 8.1.6 the initials of the person making the above entries in the sample log book.

_____ 8.2 Where there is any doubt as to the test item's suitability for testing (e.g., a mismatch between identification and description, or whether they are of a type which

can be analyzed by the laboratory), the laboratory shall have a procedure for informing the client and resolving the problem. This action shall be documented.

**9 Records**

_____ 9.1 The laboratory's quality system documentation shall have written procedures for the storage and retrieval of records.

_____ 9.2 Records are stored in a logical fashion allowing retrieval within one working day.

_____ 9.3 The laboratory shall have documentation, either electronic backup or "paper" hard copy, to verify survival of original data if computers are used for data retention.

_____ 9.4 The laboratory shall ensure that the analyst signs (or initials) and dates the original data.

_____ 9.5 The following records are maintained for a minimum of 5 years:

_____ 9.5.1 sample custody;
_____ 9.5.2 original data collected by analyst;
_____ 9.5.3 identity of personnel involved in sample preparation and testing;
_____ 9.5.4 calibration and verification data;
_____ 9.5.5 quality control activities and results;
_____ 9.5.6 equipment and maintenance;
_____ 9.5.7 test reports; and
_____ 9.5.8 records of all actions taken in response to testing complaints.

**10 Certificates and reports**

_____ 10.1 In addition to the requirements in the General Operations Checklist, each test report shall include the following information:

_____ 10.1.1 Fastener description, including:

- manufacturer (name and address);
- product family (screw, nut, bolt, washer, or stud), drive and/or head configurations as applicable;
- date of manufacture;
- head markings (describe or draw manufacturer's recorded insignia and grade identification or property class symbols);
- nominal dimensions (diameter; length of bolt, screw or stud; thickness of load bearing washer or nut); thread form and class of fit;
- product standard and specification related to the laboratory in writing by the manufacturer, importer or distributor;
- lot number and other numbers as appropriate;
- specification and grade of material;
- coating material and standard and specification, as applicable.

_____ 10.1.2 Sampling information, including;
- standard or reference for sampling scheme;
- production lot size and the number sampled and tested;
- name and affiliation of person performing the lot sampling.

_____ 10.1.3 Test results, including;
- actual tests required by standard and specification;
- test results for each sample;
- all deviations from the test method;
- all other items required on test reports according to the test method;
- where the report contains results of tests performed by subcontractors, these results shall be clearly identified along with the name of the laboratory and accreditation information listed in item 10.1.5 of this checklist;
- a statement that the samples tested either conform or do not conform to the fastener standards and specifications and explanation of any nonconformance, except as provided for in sections 280.14 and 280.15 of Title 15, Part 280 of the Code of Federal Regulations.

_____ 10.1.4 The name, title and signature of Approved Signatory accepting technical responsibility for the tests and test report.

_____ 10.1.5 The name of the body which accredited the laboratory (i.e., NVLAP) for the specific tests performed which are the subject of the report, NVLAP Lab Code assigned to the laboratory, and the expiration of accreditation.

_____ 10.2 In addition to the requirements in the General Operations Checklist, for alternative chemical tests carried out under the Fastener Quality Act, the laboratory shall provide to the fastener manufacturer, either directly or through the metal manufacturer, a written inspection and testing report containing the following information:

_____ 10.2.1 Coil or heat number of metal being tested.

_____ 10.2.2 Test results, including:
- actual tests required by standard and specification;
- test results for each sample;
- all deviations from the test method;
- all other items required on test reports according to the test method;
- where the report contains results of tests performed by subcontractors, these results shall be clearly identified along with the name of the laboratory and accreditation information listed in item 10.2.4 of this checklist; and
- a statement that the samples tested either conform or do not conform to the metal standards and specifications and explanation of any nonconformance.

_____ 10.2.3 The name, title and signature of Approved Signatory accepting technical responsibility for the tests and test report.

_____ 10.2.4 The name of the body which accredited the laboratory (i.e., NVLAP) for the specific tests performed which are the subject of the report, NVLAP Lab Code assigned to the laboratory, and the expiration of accreditation.

_____ 10.3 The laboratory uses a tamper-resistant system to protect test reports.

**11 Subcontracting of calibration or testing**

_____ 11.1 Testing conducted under the requirements of the Fastener Quality Act (FQA) is subcontracted to a laboratory that is accredited under the provisions of the FQA regulations.

**12 Outside support services and supplies**

(See General Operations Checklist.)

**13 Complaints**

(See General Operations Checklist.)

**14 Proficiency testing**

_____ 14.1 The laboratory shall participate in the mandatory NVLAP Proficiency Testing program, which includes (but is not limited to) the following:

_____ 14.1.1 analyses are not contracted out to another laboratory;
_____ 14.1.2 laboratory keeps and utilizes proficiency testing materials for use as in-house instructional materials;
_____ 14.1.3 one single result is reported back to NVLAP, or its contractor, by the laboratory unless otherwise specified in the testing instructions;
_____ 14.1.4 plans are developed and implemented for resolving problems and are documented; and
_____ 14.1.5 copies of proficiency testing reports, and data sheets are maintained for a minimum of 5 years.

NVLAP LAB CODE: [ ]

## SPECIFIC OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

**Instructions to the Assessor:** Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

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## SPECIFIC OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

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# APPENDIX D

# ON-SITE ASSESSMENT - TEST METHOD REVIEW

NVLAP LAB CODE: _____

# NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM

## ON-SITE ASSESSMENT - TEST METHOD REVIEW

**Instructions to the Assessor:**

During the on-site visit you will be required to assess the laboratory's ability to conduct the specific test methods for which it has applied for accreditation. In some cases this will involve many test methods. You may not have sufficient time to perform an in-depth assessment of each method.

Use the attached sheets to indicate which test methods you assessed at the laboratory, and the extent of your assessment. Indicate whether you performed an in-depth review, including a full review of laboratory activities. These include sample control and preparation, procedure review, observation of actual testing, environmental control check, equipment review, calibration checks, record-keeping practices and report forms; or, that you observed selected items to determine that the laboratory demonstrated the ability to conduct the test.

Fill out the ON-SITE ASSESSMENT - TEST METHOD REVIEW SUMMARY by writing in the test method designation. All test methods should be given the greatest depth of assessment that time and practicality allow. Indicate on the summary the DEPTH of the assessment for each test method you reviewed, using one of the symbols shown below:

OT - (Observed Test)
EA - (Examined Apparatus)
W/TT - (Walked/Talked Through)
LDP - (Listened to Description of Procedures)

For the remaining categories, mark each with an "X" if a deficiency is identified, a "C" if you wish to make a comment, or a "✓" if all requirements have been met. All ***deficiencies*** must be accompanied by a comment.

Use the ON-SITE ASSESSMENT - TEST METHOD REVIEW COMMENTS AND DEFICIENCIES sheets to write comments on what you observed. Preface each comment with the test method designation to which the comment applies. Please be liberal with your comments so that we have a good written record of your observations; the more information we have, the better the accreditation decision we can make.

Special Instruction:

NVLAP LAB CODE:

## National Voluntary Laboratory Accreditation Program (NVLAP)

## ON-SITE ASSESSMENT - TEST METHOD REVIEW SUMMARY

| Test Method (number, name or designation) | Depth of Assessment | Accommodation/ Environment | Equipment/ Reference Materials | Calibration | Test Method Procedures | Handling/ Prep. of Test Items | Test Reports | Other Considerations |
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## ON-SITE ASSESSMENT - TEST METHOD REVIEW COMMENTS AND DEFICIENCIES

**Instructions to the Assessor:** Use this sheet to document comments and deficiencies. For each, identify the appropriate item number. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

| *Test Method (number, name, or designation)* | *Comments and/or Deficiencies as Noted on the On-Site Assessment - Test Method Review Summary* |
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# APPENDIX E

# MAJOR AREAS OF TESTING

## FASTENERS AND METALS PROGRAM
## MAJOR AREAS OF TESTING

### 1. MECHANICAL AND PHYSICAL TESTING AND INSPECTION

1.1 Aerospace nut tests

- 1.1.1 Flareability test of clinch and shank nuts
- 1.1.2 Permanent set test of self-locking nuts
- 1.1.3 Push out test of floating plate nuts, gang channel nuts, and anchor nuts
- 1.1.4 Reusability test of self-locking internally threaded fasteners
- 1.1.5 Room temperature of three cycles test of floating plate nuts, gang channel nuts and anchor nuts
- 1.1.6 Torque-out test
- 1.1.7 Wrench torque test of externally wrenched nuts of spline and hexagon and double hexagon (12 point) wrenching configuration

1.2 Adhesion

Adhesion of metallic coatings on fasteners

1.3 Bend

Bend test of full size eyebolts

1.4 Coating/plating thickness

- 1.4.1 Measurement of fastener coating thickness - eddy-current method
- 1.4.2 Measurement of fastener coating thickness - magnetic methods
- 1.4.3 Measurement of fastener coating thickness - microscopical method
- 1.4.4 Measurement of fastener coating thickness - weight of coating
- 1.4.5 Measurement of fastener coating thickness - beta backscatter method
- 1.4.6 Measurement of fastener coating thickness - coulometric method
- 1.4.7 Measurement of fastener coating thickness - dimensional change method
- 1.4.8 Measurement of fastener coating thickness - X-ray methods

1.5 Corrosion

- 1.5.1 Salt spray testing of fasteners
- 1.5.2 Humidity testing of fasteners
- 1.5.3 Stress corrosion of fasteners
- 1.5.4 Intergranular corrosion susceptibility in austenitic stainless steel fasteners - nitric acid test
- 1.5.5 Intergranular corrosion susceptibility of austenitic stainless steel fasteners - oxalic acid etch test
- 1.5.6 CASS test (copper-accelerated acetic acid-salt spray test) of fasteners
- 1.5.7 Water immersion test - test for anodic surface contaminants on corrosion resistant fasteners
- 1.5.8 Copper sulfate test - test for free iron on the surface of corrosion resistant fasteners

1.6 Elevated temperature testing

Elevated temperature testing capability

1.7 Embrittlement

1.7.1 Hydrogen embrittlement (stress durability) of externally threaded fasteners
1.7.2 Hydrogen embrittlement (stress durability) of internally threaded fasteners (nuts)
1.7.3 Test for embrittlement of metallic coated externally threaded fasteners

1.8 Fatigue

Fatigue of full-size threaded fasteners

1.9 Hardness

1.9.1 Brinell hardness of fasteners
1.9.2 Microhardness of fasteners
1.9.3 Rockwell hardness of fasteners
1.9.4 Rockwell superficial hardness of fasteners
1.9.5 Vickers hardness - test forces from 9.807 to 1176 N (1 to 120 kgf)

1.10 Impact

1.10.1 Charpy impact (v-notch) testing
1.10.2 Charpy impact (u-notch) testing

1.11 Magnetic permeability

Magnetic permeability of fasteners using a low-mu permeability indicator

1.12 Prevailing torque

Prevailing torque of full-size prevailing-torque type nuts

1.13 Proof

1.13.1 Cone proof load of internally threaded fasteners (nuts)
1.13.2 Proof load of full-size externally threaded fasteners
1.13.3 Proof load of full-size eyebolts
1.13.4 Proof load of internally threaded fasteners (nuts)

1.14 Rotational capacity

Rotational capacity of full-size threaded fasteners

1.15 Screw tests

1.15.1 Clamp load test
1.15.2 Drill-drive test
1.15.3 Drive test
1.15.4 Ductility test of thread rolling and self-drilling tapping screws
1.15.5 Proof torque test
1.15.6 Torsional strength test of thread rolling and self-drilling tapping screws

1.16 Shear

1.16.1 Single shear of externally threaded fasteners
1.16.2 Double shear of externally threaded fasteners

1.17 Stress Rupture

Stress rupture of fasteners

1.18 Tensile

1.18.1 Axial tensile strength of full-size threaded fasteners
1.18.2 Breaking strength of full-size eyebolts
1.18.3 Tension testing of machined specimens from externally threaded fasteners
1.18.4 Total extension at fracture of externally threaded fasteners
1.18.5 Wedge tensile strength of full-size threaded fasteners
1.18.6 Yield strength of full-size externally threaded fasteners

1.19 Torque/tension

1.19.1 Torque-tension of full-size threaded fasteners
1.19.2 Recess strength test in both the installation and removal directions

1.20 Vibration

Vibration of full-size threaded fasteners

1.21 Washer tests

1.21.1 Compression load of compressible-washer-type direct tension indicators
1.21.2 Embrittlement test of washers
1.21.3 Recovery test of washers
1.21.4 Temper test of lock washers
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